COUNTY OF SAN DIEGO

GUIDELINES FOR DETERMINING SIGNIFICANCE AND REPORT FORMAT AND CONTENT REQUIREMENTS

NOISE

LAND USE AND ENVIRONMENT GROUP

Department of Planning and Land Use
Department of Public Works

March 19, 2007

APPROVAL

I hereby certify that these **Guidelines for Determining Significance and Report Format and Content Requirements for Noise** are a part of the County of San Diego, Land Use and Environment Group's Guidelines for Determining Significance and Technical Report Format and Content Requirements and were considered by the Director of Planning and Land Use, in coordination with the Director of Public Works on the 19th day of March, 2007.

GARY PRYOR
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Attest: ERIC GIBSON
Deputy Director of Planning and Land Use

I hereby certify that these **Guidelines for Determining Significance and Report Format and Content Requirements for Noise** are a part of the County of San Diego, Land Use and Environment Group's Guidelines for Determining Significance and Technical Report Format and Content Requirements and have hereby been approved by the Deputy Chief Administrative Officer (DCAO) of the Land Use and Environment Group on the 19th day of March, 2007. The Director of Planning and Land Use is authorized to approve revisions to these Guidelines for Determining Significance and Report Format and Content Requirements for Noise except any revisions to the Guidelines for Determining Significance presented in Chapter 4.0 must be approved by the Deputy CAO.

Approved, March 19, 2007

Chandra Wallar

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Deputy CAO

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EXPLANATION

These Guidelines for Determining Significance for Noise and information presented herein shall be used by County staff for the review of discretionary projects and environmental documents pursuant to the California Environmental Quality Act (CEQA). These Guidelines present a range of quantitative, qualitative, and performance levels for particular environmental effects. Normally, (in the absence of substantial evidence to the contrary), an affirmative response to any one Guideline will mean the project will result in a significant effect, whereas effects that do not meet any of the Guidelines will normally be determined to be "less than significant." Section 15064(b) of the State CEQA Guidelines states:

> "The determination whether a project may have a significant effect on the environment calls for careful judgment on the part of the public agency involved, based to the extent possible on factual and scientific data. An ironclad definition of significant effect is not always possible because the significance of an activity may vary with the setting."

The intent of these Guidelines is to provide a consistent, objective and predictable evaluation of significant effects. These Guidelines are not binding on any decision-maker and do not substitute for the use of independent judgment to determine significance or the evaluation of evidence in the record. The County reserves the right to modify these Guidelines in the event of scientific discovery or alterations in factual data that may alter the common application of a Guideline.

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List of Acronyms

ANSI	American National Standards Institute
CALTRANS	California Department of Transportation
CEQA	California Environmental Quality Act
CNEL	Community Noise Exposure Level
dB	Decibel
dB re	dB reference to
DNL	Day-Night Average Sound Level
DPLU	Department of Planning and Land Use
VdB	Vibration velocity level in decibels
dBA	A-weighted Sound Pressure Level
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
HVAC	Heating, Ventilation, and Air Conditioning
Hz	Hertz
ISO	International Organization for Standardization
Ldn	Day-Night Average Sound Level
Leq	Equivalent Sound Level
Leq(h)	One-Hour Equivalent Noise Level
NSLU	Noise Sensitive Land Use
rms	Root mean square
sec	Second

INTRODUCTION

This document provides guidance for evaluating any substantial environmental effects that a proposed project may have from noise. Specifically, this document aids in addressing the following questions listed in the California Environmental Quality Act (CEQA) Guidelines, Appendix G, XI. Noise:

Would the project:

a) Result in exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

b) Result in exposure of persons to or generation of excessive ground borne vibration or ground borne noise levels?

c) Result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?

d) Result in a substantial temporary[1] or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?

e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?

f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?

Depending on intensity, frequency, duration and other factors, noise can affect human health and quality of life. Noise problems can manifest themselves in two general ways:

- The absolute level of noise can generate impacts to existing or reasonably forseeable future noise sensitive land uses; or

- A substantial increase to the ambient noise levels existing before project implementation can generate impacts to preexisting noise sensitive land uses.

[1] Temporary – For purposes of materials handling and impact equipment noise assessments, "temporary" is defined as one month of operation, or 240 hours, within 3 consecutive calendar months. Any material handling or impact equipment in continuous operation longer than this period may be considered an operation and would no longer be covered under the noise construction ordinance. Evaluation of construction work is dependent on the project site and its situation (i.e., fixed or mobile sources, proximity to other land uses, and type of noise source).

There are a number of noise level standards in existing Federal, State, and local regulations. The County of San Diego has two principal noise regulations, the Noise Element of the General Plan and the Noise Ordinance. The Noise Element of the General Plan establishes sound level limits for noise received at noise sensitive land uses. It identifies the major sources of noise to be airports and traffic on public roadways. The Noise Ordinance establishes sound level limits for noise sources. In addition, there are other Federal, State and local regulations that address airport and federally funded highway noise.

1.0 TERMS, GENERAL PRINCIPLES, AND EXISTING CONDITIONS

1.1 Terms

Environmental noise is comprised of infinite combinations of sound intensities of varying frequency and duration. In order to reasonably characterize environmental noise the following weighted and averaging terms are utilized:

1.1.1 A-weighted Sound Pressure Level (dB or dBA)

Some frequencies of noise are more noticeable than others. To compensate for this fact, different sound frequencies are weighted more heavily (A-weighted) so that the response of the average human ear is simulated.

1.1.2 Equivalent Sound Level (Leq)

Environmental noise often fluctuates over time. To be able to describe this in a practicable manner the Leq was developed. Leq is the A-weighted steady sound level that contains the same total acoustical energy as the actual fluctuating sound level.

1.1.3 One-Hour Equivalent Noise Level (Leq(h))

A one-hour equivalent noise level is a measurement of noise intensity, which is the equivalent sound level (Leq) over a one hour averaging period.

1.1.4 Community Noise Equivalent Level (CNEL)

This term applies weights to noise during evening and nighttime hours to compensate for the increased sensitivity of people to noise at those times. CNEL is the equivalent sound level for a 24-hour period with a +5 dB weighting applied to all sound occurring between 7:00 p.m. and 10:00 p.m. and a +10 dB weighting applied to all sound occurring between 10:00 p.m. and 7:00 a.m. CNEL is expressed in the A-weighting frequency scale. In the case of airport or aircraft noise, CNEL is often expressed as a 365-day average.

1.1.5 Day-Night Average Sound Level (DNL)

This term is similar to CNEL except it does apply any weights to the evening hours to compensate for the increased sensitivity to noise. DNL is a 24-hour weighted average and also uses an A-weighted frequency scale. DNL is normally within 1 dB of CNEL using the same 24-hour data.

1.1.6 Noise Sensitive Land Use (NSLU)

Any residence, hospital, school, hotel, resort, library, or similar facility where quiet is an important attribute of the environment.

1.2 General Principles and Existing Conditions

Noise is typically defined as unwanted sound. The main characteristics of sound are intensity, frequency and duration. The decibel (dB) is the typical measurement of sound intensity. A sound level of 0 dB approximates the threshold of hearing for people. Sound levels of typical community noise sources and community noise environment are illustrated in Attachment A. However, the average person can perceive a change of +/-3 dB. A change of +/-5 dB is readily perceptible and a change of +10 dB is perceived as twice as loud. Noise can have both human health and quality of life effects. At 130 to 140 dB, sound becomes extremely painful to the average person. Data shows that long exposure to noise levels exceeding 85 dB can result in hearing loss and other health-related problems (OSHA, 2006). The community noise environment is normally unacceptable for residential sites that are exposed to noise where the day-night average sound level (DNL) exceeds 75 decibels (HUD, 1991). From a quality of life standpoint, noise can interfere with speech, disturb sleep and cause annoyance. Attachment B reflects the results of studies on the relationship between noise exposure and percentage of community highly annoyed by noise. The studies demonstrated that approximately four percent (4%) of a community is highly annoyed by community noise levels equivalent to 55 dB CNEL, and about fourteen percent (14%) of a community can be highly annoyed by community noise levels equivalent to 65dB CNEL. Additionally, an increase in the ambient or periodic noise level can cause quality of life impacts even when the absolute noise level does not exceed 55-65 dB CNEL. A study by the International Standard Organization (ISO) found that sound level changes of 5-10 dB generated sporadic complaints from existing residents. Changes of 10 dB or more generated widespread complaints.

Frequency of sound is measured in Hertz (Hz) or cycles per second. The generally accepted range of human hearing ranges from approximately a low of 20 Hz to a high of 20,000 Hz. Some frequencies are more noticeable and annoying than others.

When compared to most other environmental issues, noise level standards are comprehensive in existing Federal, State, and local regulations. These standards are generally the result of socioeconomic studies that balance quality of life issues with

reasonable development needs. This association is shown in Attachment B, "Relationship between Noise Exposure and Percentage of Community Highly Annoyed."

2.0 EXISTING REGULATIONS AND STANDARDS

Due to the human health and quality of life concerns addressed above, Federal, State, and local agencies have established limits for community noise and occupational noise. These allowable sound level limits are based on psycho-acoustical and health considerations as well as socioeconomic and technical considerations. The County of San Diego has two principal noise regulations, the Noise Element of the General Plan and the Noise Ordinance. The following summarizes the salient aspects of these regulations and other regulations that typically apply to projects within the unincorporated area of San Diego County.

2.1 Federal Regulations and Standards

Federal Aviation Administration (FAA) Standards [FAR Part 150, Section 150.21]
The FAA establishes 65 dB CNEL as the noise standard associated with aircraft noise.

Federal Highway Administration (FHWA) Standards [23 CFR Chapter 1, Part 772, Section 772.19]
For federally funded road construction projects, the Federal Highway Administration (FHWA) standards preempt County standards. The FHWA establishes specific noise standards for different land use categories for federal highway projects. Please refer to the State of California protocol for implementation of these FHWA standards.

Federal Railroad Administration (FRA) Standards [High-speed Ground Transportation and Vibration Impact Assessment Manual, August 2005, http://www.fra.dot.gov/downloads/RRDev/final_nv.pdf]
For high-speed ground transportation (HSGT) projects, responsible agencies require methods in this manual for NEPA evaluation of a project's potential impacts considering the adjacent land uses categories, existing ambient conditions, and future exposure levels. The assessment provides methods to assist in the evaluation of high-speed designs in contrast to more standard mass transit developments. For a federally funded project, the Federal Railroad Administration (FRA) standards preempt County standards.

Federal Transit Authority Standards (FTA) [Transit Noise and Vibration Impact Assessment, Manual, May 2006,http://www.fta.dot.gov/documents/FTA_Noise_and_Vibration_Manual.pdf]
For federally funded mass transit projects, the Federal Transit Authority (FTA) standards preempt County standards. The County currently relies on the vibration standards listed in this document (Attachment D).

2.2 State Regulations and Standards

California Environmental Quality Act (CEQA) [California Code of Regulations, Guidelines for Implementation of CEQA, Appendix G, Title 14, Chapter 3 §15000-15387 and 21000-21178, http://ceres.ca.gov/topic/env law/ceqa/guidelines/]
The California Environmental Quality Act (CEQA) requires lead agencies to consider noise impacts. Under CEQA, lead agencies are directed to assess conformance to locally established noise standards or other agencies' noise standards; measure and identify the potentially significant exposure of people to or generation of excessive ground borne vibration or noise levels; measure and identify potentially significant permanent or temporary increases in ambient noise levels; and measure and identify potentially significant impacts associated with air traffic.

California Noise Control Act [California Health and Safety Code 46000-46080 http://www.leginfo.ca.gov/calaw.html]
This section of the California Health and Safety Code finds that excessive noise is a serious hazard to the public health and welfare and that exposure to certain levels of noise can result in physiological, psychological, and economic damage. It also finds that there is a continuous and increasing bombardment of noise in the urban, suburban, and rural areas. The California Noise Control Act declares that the State of California has a responsibility to protect the health and welfare of its citizens by the control, prevention, and abatement of noise. It is the policy of the State to provide an environment for all Californians free from noise that jeopardizes their health or welfare.

California Noise Insulation Standards [California's Title 24 Noise Standards. Cal. Adm. Code Title 24, Chap. 2-35 http://ccr.oal.ca.gov/]
In 1974, the California Commission on Housing and Community Development adopted noise insulation standards for multi-family residential buildings (Title 24, Part 2, California Code of Regulations). Title 24 establishes standards for interior room noise (attributable to outside noise sources). The regulations also specify that acoustical studies must be prepared whenever a residential building or structure is proposed to be located near an existing or adopted freeway route, expressway, parkway, major street, thoroughfare, rail line, rapid transit line, or industrial noise source, and where such noise source or sources create an exterior CNEL (or Ldn) of 60 dB or greater. Such acoustical analysis must demonstrate that the residence has been designed to limit intruding noise to an interior CNEL (or Ldn) of at least 45 dB.

2.3 Local Regulations and Standards

San Diego County General Plan, Noise Element, (Part VIII)
[http://ceres.ca.gov/planning/counties/San_Diego/plans.html]
The Noise Element of the County of San Diego General Plan establishes limitations on sound levels to be received by noise sensitive land uses (NSLUs). New development may cause an existing NSLU to be affected by noise caused by the new development, or it may create or locate a NSLU in such a place that it is affected by noise. The Noise Element identifies airports and traffic on public roadways as the major sources of noise.

The Noise Element states that an acoustical study is required if it appears that a NSLU would be subject to noise levels of CNEL equal to 60 decibels (A) or greater. If that study confirms that greater than 60 dB CNEL would be experienced, modifications that reduce the exterior noise level to less than 60 dB CNEL and the interior noise levels to below 45 dB CNEL must be made to the development. If these modifications are not made, the development shall not be approved unless a finding is made that specific social or economic considerations warrant project approval; provided, that if the noise level would exceed 75 dB CNEL(A) even with such modifications, the development shall not be approved irrespective of such social or economic considerations.

"CNEL" is the Community Noise Equivalent Level, which is a 24-hour averaged measurement based upon the "(A)" or A-weighted sound levels, with certain penalties assigned to evening and nighttime noise, as described in Chapter 2 of the Noise Element. "Development" is defined as any physical development including but not limited to residences, commercial or industrial facilities, roads, civic buildings, hospitals, schools and airports. A "NSLU" is defined as any residence, hospital, school, hotel, resort, library, or any other facility where quiet is an important attribute of the environment. "Exterior Noise" means noise measured at an outdoor living area that meets specified minimum area requirements for single family detached dwelling projects, and for other projects it means noise measured at all exterior areas which are provided for group or private usable open space.

The Noise Element includes special provisions for County road construction projects and interior noise levels in rooms that are usually occupied only a part of the day (schools, libraries, etc.).

County of San Diego Noise Ordinance [San Diego County Code of Regulatory Ordinances. Title 3. Division 6. Chapter 4. Section 36.401
http://www.sdcounty.ca.gov/dplu/Resource/docs/3~pdf/NoiseOrdinance.pdf]
The County of San Diego Noise Ordinance establishes prohibitions for disturbing, excessive, or offensive noise, and provisions such as sound level limits for the purpose of securing and promoting the public health, comfort, safety, peace, and quiet for its citizens. Planned compliance with sound level limits and other specific parts of the ordinance allows presumption that the noise is not disturbing, excessive, or offensive. Limits are specified depending on the zoning placed on a property (e.g., varying densities and intensities of residential, industrial and commercial zones). Where two adjacent properties have different zones, the sound level limit at a location on a boundary between two properties is the arithmetic mean of the respective limits for the two zones, except for extractive industries. It is unlawful for any person to cause or allow the creation of any noise that exceeds the applicable limits of the Noise Ordinance at any point on or beyond the boundaries of the property on which the sound is produced. Furthermore, the Noise Ordinance allows the County to grant variances from the noise limitations for temporary on-site noise sources, subject to terms and conditions intended to achieve compliance. Finally, the Noise Ordinance establishes additional noise limitations for operation of construction equipment.

3.0 TYPICAL ADVERSE EFFECTS

Typical noise-related adverse effects associated with new development projects generally fall into the following categories: noise from construction of the development, noise from the operation of the development, and the exposure of NSLUs to existing and future noise from all sources.

3.1 Construction Activities

Construction causes the exposure of on- or off- site areas to noise associated with project-related activities including but not limited to; site grading, truck/construction equipment movement, engine noise, rock excavation, rock crushing, and blasting.

3.2 Operational Activities

Operation of a facility can cause the exposure of on- or off- site areas to increased noise associated with operation of projects including but not limited to; mechanical equipment (pumps, rooftop equipment, condenser units, A/C units, pneumatic equipment), operation related traffic (vehicle movement, engine noise), speakers, bells, chimes, and outdoor human activity in defined limited areas,.

3.3 Exposure of Noise Sensitive Land Uses (NSLUs)

Exposure of NSLUs to existing and future noise from all sources, particularly roads and highways, railroads, airports, heliports or extractive industries is another typical adverse effect of development. This includes noise caused by new development impacting existing or forseeable future NSLUs. It also includes new development which creates or locates NSLUs in such a place that they are impacted by noise (a typical example being a new residential project locating residences close to a highway).

3.4 Exposure of Noise Sensitive Avian Species

Exposure of selected avian species to noise caused by development and related activities is also another typical adverse effect. Such an effect is addressed by the County's Biological Significance Guidelines 4.1.G and 4.1.J. The acoustical assessment of this issue is normally documented in the project's biological resource studies. However, complex projects may require a more complete acoustical assessment that provides distances for anticipated noise levels from project-related construction activities and onsite noise sources for use by the biologist in determining noise-related impacts to noise sensitive habitat/species.

4.0 GUIDELINES FOR DETERMINING SIGNIFICANCE

An affirmative response to or confirmation of any one of the following Guidelines will generally be considered a significant impact related to noise as a result of project implementation, in the absence of scientific evidence to the contrary:

4.1 Noise Sensitive Land Uses Affected by Airborne Noise

Project implementation will result in the exposure of any on- or off-site, existing or reasonably foreseeable future NSLU to exterior or interior noise (including noise generated from the project, together with noise from roads [existing and planned Circulation Element roadways], railroads, airports, heliports and all other noise sources) in excess of any of the following:

A. Exterior Locations:

i. 60 dB (CNEL)[2]; or

ii. An increase of 10 dB (CNEL) over pre-existing noise.

In the case of single-family residential detached NSLUs, exterior noise shall be measured at an outdoor living area which adjoins and is on the same lot as the dwelling, and which contains at least the following minimum area:

(1) Net lot area up to 4,000 square feet: 400 square feet
(2) Net lot area 4,000 sq. ft. to 10 acres: 10% of net lot area
(3) Net lot area over 10 acres: 1 acre

For all other projects, exterior noise shall be measured at all exterior areas provided for group or private usable open space.

B. Interior Locations:

45 dB (CNEL) except for the following cases:

i. Rooms which are usually occupied only a part of the day (schools, libraries, or similar facilities), the interior one-hour average sound level due to noise outside should not exceed 50 decibels (A).
ii. Corridors, hallways, stairwells, closets, bathrooms, or any room with a volume less than 490 cubic feet.

[2] If any adopted community noise standard is more stringent than the exterior criterion of 60 decibels CNEL, the analysis of any related impacts due to this standard shall be considered a potential land use impact. The criteria listed in this document are still applicable in all environmental acoustical studies for compliance to CEQA.

4.2 Project – Generated Airborne Noise

The project will generate airborne noise which, together with noise from all sources, will be in excess of either of the following:

A. Non-Construction Noise: The limit specified in San Diego County Code Section 36.404, Sound Level Limits, at or beyond the property line. Section 36.404 provides the following limits (Table 1):

Table 1
San Diego County Code Section 36.404, Sound Level Limits

ZONE		APPLICABLE LIMIT ONE-HOUR AVERAGE SOUND LEVEL (DECIBELS)
R-S, R-D, R-R, R-MH, A-70, A-72, S-80, S-81, S-87, S-88, S-90, S-92, R-V, and R-U Use Regulations with a density of less than 11 dwelling units per acre.	7 a.m. to 10 p.m. 10 p.m. to 7 a.m.	50 45
R-RO, R-C, R-M, C-30, S-86, R-V, R-U and V5. Use Regulations with a density of 11 or more dwelling units per acre.	7 a.m. to 10 p.m. 10 p.m. to 7 a.m.	55 50
S-94, V4, and all other commercial zones.	7 a.m. to 10 p.m. 10 p.m. to 7 a.m.	60 55
V1, V2 V1, V2 V1 V2	7 a.m. to 7 p.m. 7 p.m. to 10 p.m. 10 p.m. to 7 a.m. 10 p.m. to 7 a.m.	60 55 55 50
V3	7 a.m. to 10 p.m. 10 p.m. to 7 a.m.	70 65
M-50, M-52, M-54	Anytime	70
S-82, M-58, and all other industrial zones.	Anytime	75

If the measured ambient level exceeds the applicable limit noted above, the allowable one hour average sound level shall be the ambient noise level. The ambient noise level shall be measured when the alleged noise violation source is not operating.

The sound level limit at a location on a boundary between two (2) zoning districts is the arithmetic mean of the respective limits for the two districts; provided however, that the one-hour average sound level limit applicable to extractive industries, including but not

limited to borrow pits and mines, shall be 75 decibels at the property line regardless of the zone where the extractive industry is actually located.

Fixed-location public utility distribution or transmission facilities located on or adjacent to a property line shall be subject to the noise level limits of this section, measured at or beyond six (6) feet from the boundary of the easement upon which the equipment is located.

B. Construction Noise: Noise generated by construction activities related to the project will exceed the standards listed in San Diego County Code Section 36.410, Construction Equipment.

Section 36.410 states:

Except for emergency work,

(a) It shall be unlawful for any person to operate construction equipment between the hours of 7 p.m. of any day and 7 a.m. of the following day.

(b) It shall also be unlawful for any person to operate construction equipment on Sundays, and days appointed by the President, Governor, or the Board of Supervisors for a public fast, Thanksgiving, or holiday, but a person may operate construction equipment on the above-specified days between the hours of 10 a.m. and 5 p.m. at his residence or for the purpose of constructing a residence for himself, provided that the average sound level does not exceed 75 decibels during the period of operation and that the operation of construction equipment is not carried out for profit or livelihood.

(c) It shall also be unlawful to operate any construction equipment so as to cause at or beyond the property line of any property upon which a legal dwelling unit is located an average sound level greater than 75 decibels between the hours of 7 a.m. and 7 p.m.

(Amended by Ord. No. 9700 (N.S.), effective 2-4-05)

For construction activities, the County considers the 75 decibel (A) average to be based on a period of one hour.

4.3. Ground-Borne Vibration and Noise Impacts

Exposure of NSLUs and other vibration sensitive uses (i.e., research and manufacturing) to existing and future ground-borne vibration and noise arising from operations related to, but not limited by, materials handling, blasting, transportation corridors, railroads, and extractive industries is another typical adverse effect of development. This includes vibration sources caused by new development impacting existing or forseeable future NSLUs and vibration sensitive uses. It also includes new development which creates or locates NSLUs and other vibration sensitive uses in such

a place that they are impacted by ground-borne vibration and noise (a typical example being a new residential project locating residences close to a commuter railroad line).

Project implementation will expose the uses listed in Table 2 and 3 to ground-borne vibration or noise levels equal to or in excess of the levels shown.

Table 2
Guideline for Determining the Significance of
Ground-borne Vibration and Noise Impacts

Land Use Category	Ground-Borne Vibration Impact Levels (inches/sec rms)		Ground-Borne Noise Impact Levels (dB re 20 micro Pascals)	
	Frequent Events[1]	Occasional or Infrequent Events[2]	Frequent Events[1]	Occasional or Infrequent Events[2]
Category 1: Buildings where low ambient vibration is essential for interior operations. (research & manufacturing facilities with special vibration constraints)	0.0018 [3]	0.0018 [3]	Not applicable[5]	Not applicable[5]
Category 2: Residences and buildings where people normally sleep. (hotels, hospitals, residences, & other sleeping facilities)	0.0040	0.010	35 dBA	43 dBA
Category 3: Institutional land uses with primarily daytime use. (schools, churches, libraries, other institutions, & quiet offices)	0.0056	0.014	40 dBA	48 dBA

Source: U.S Department of Transportation, Federal Transit Administration, "Transit Noise and Vibration Impact Assessment," May 2006.

Notes to Table 2:

1. "Frequent Events" is defined as more than 70 vibration events per day. Most rapid transit projects fall into this category.
2. "Occasional or Infrequent Events" are defined as fewer than 70 vibration events per day. This combined category includes most commuter rail systems.
3. This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. Vibration sensitive manufacturing or research will require detailed evaluation to define acceptable vibration levels. Ensuring lower vibration levels in a building often requires special design of the HVAC systems and stiffened floors.
4. Vibration-sensitive equipment is not sensitive to ground-borne noise.
5. There are some buildings, such as concert halls, TV and recording studios, and theaters, that can be very sensitive to vibration and noise but do not fit into any of the three categories. Table 3 gives criteria for acceptable levels of ground-borne vibration and noise for these various types of special uses.
6. For Categories 2 and 3 with occupied facilities, isolated events such as blasting are significant when the peak particle velocity (PPV) exceeds one inch per second. Non-transportation vibration sources such as impact pile drivers or hydraulic breakers are significant when their PPV exceeds 0.1 inch per second. More specific criteria for structures and potential annoyance were developed by Caltrans (2004) and will be used to evaluate these continuous or transient sources in San Diego County.

Table 3
Guideline for Determining the Significance of
Ground-Borne Vibration and Noise Impacts for Special Buildings

Type of Building or Room	Ground-Borne Vibration Impact Levels (inches/sec rms)		Ground-Borne Noise Impact Levels (dB re 20 micro Pascals)	
	Frequent Events[1]	Occasional or Infrequent Events[2]	Frequent Events[1]	Occasional or Infrequent Events[2]
Concert Halls, TV Studios, and Recording Studios	0.0018	0.0018	25dBA	25dBA
Auditoriums	0.0040	0.010	30 dBA	38 dBA
Theaters	0.0040	0.010	35 dBA	43 dBA

Source: U.S Department of Transportation, Federal Transit Administration, "Transit Noise and Vibration Impact Assessment," May 2006.

Notes to Table 3:

1. "Frequent Events" is defined as more than 70 vibration events per day. Most rapid transit projects fall into this category.
2. "Occasional or Infrequent Events" are defined as fewer than 70 vibration events per day. This combined category includes most commuter rail systems.
3. If the building will rarely be occupied when the trains are operating, there is no need to consider impact.
4. For historic buildings and ruins, the allowable upper limit for continuous vibration to structures is identified to be 0.056 inches/second rms. Transient conditions (single-event) would be limited to approximately twice the continuous acceptable value.

4.4 Sources for Guidelines

The significance guidelines listed above have been selected for the following reasons:

Significance guidelines 4.1.A, 4.1.B, 4.2.A, and 4.2.B are derived from existing local noise standards which in turn, were derived from State regulation to address human health and quality of life concerns. Additionally the guidelines are based on study results of the relationship between noise exposure and percentage of community highly annoyed by noise (see Attachment B). Guideline 4.1.A is based on the San Diego County General Plan, Noise Element, Policy 4b, which establishes local noise standards for noise sensitive land uses. Guidelines 4.2.A and 4.2.B are based on the San Diego County Code of Regulatory Ordinances, Title 3, Division 6, Chapter 4 Noise Abatement and Control, Sections 36.404 Sound Level Limits and 36.410, Construction Equipment.

Significance guideline 4.1.A.ii sets a limit for when a project will increase noise levels by 10 dB CNEL or more. This guideline is based on studies completed by the ISO on the topic of acoustics (ISO 362; ISO 1996 1-3; ISO 3095; and ISO 3740-3747). An increase of 10 dB is perceived as twice as loud; therefore, significantly increases the ambient sound level. Moreover, the ISO standard is in general conformance with State (+12 dB, CalTrans) and Federal (+10 to 15 dB, Federal Highway Administration) standards.

Significance guideline 4.1.B sets the interior noise level requirements based on Title 24 standards with exceptions for daytime uses and habitable rooms. 4.1.B.i sets a conservative limit for when a project will expose daytime noise sensitive areas for learning and study to "unsteady" background sources such as transportation noise defined by the American National Standards Institute (ANSI S12.60-2002 Guidelines). 4.1.B.ii identifies the minimum volume of a habitable room for interior noise analysis based on the dimensions described in Section 310.6 of Chapter 3 in the California Code of Regulations.

Significance guideline 4.3 establishes a limit for when a project will expose sensitive land uses to ground-borne vibrations or noise. This principal guideline for significance is based upon a report prepared by Harris, Miller, Miller & Hanson Inc., for the U.S. Department of Transportation titled "Transit Noise and Vibration Impact Assessment," dated May 2006. The report details levels of ground-borne vibration and noise that may be harmful or interfere with noise sensitive land uses, as represented by the "Guidelines for Determining Significance of Ground-Borne Vibration and Noise Effects" table in the report. The study focuses on ground-borne vibration and noise impacts associated with public transit, with an emphasis on transit that uses steel wheel system (i.e. trains). A second report by Jones and Stokes for the California Department of Transportation titled "Transportation- and Construction-induced Vibration Guidance Manual," dated June 2004 provided additional materials and explanations for the tabulated results and footnotes.

5.0 STANDARD MITIGATION AND PROJECT DESIGN CONSIDERATIONS

Noise mitigation measures used in the planning and land use approval process depend on the project under consideration, and the stage in the development process where the environmental analysis is being performed. At the land subdivision stage of project processing (e.g., Tentative Map or Tentative Parcel Map), noise-related design information is typically unavailable. Because of this, certain noise mitigation measures such as those related to precise design and construction requirements for structures cannot be utilized. For such projects, the Department of Planning and Land Use (DPLU) identifies the areas where protection is needed to assure that existing or future noise levels do not significantly affect noise sensitive uses, and applies a "noise protection easement" to those areas. The "noise protection easement" ensures that construction design or other technical noise mitigation measures are implemented as necessary to achieve mitigation. DPLU assures the application of these noise mitigation measures at later stages of project processing (Site Plan, Grading Plan, Building Permit).
A similar approach is used during the rezone of the property. At this stage of the project processing, a "D" (Design) designator for noise is typically used to identify the area where protection is needed for noise sensitive uses.

At other stages of project processing, for example the Major Use Permit or Site Plan stage, typically sufficient site-specific design information is known, that specific design and construction noise mitigation measures may be determined. These noise mitigation measures can be included in the project's document of approval. A variety of noise mitigation measures can be used, including site design, outdoor living area location, project grading, noise attenuation walls and berms, etc. Technical and administrative noise mitigation measures can also be implemented, to reduce noise impacts from noise-producing equipment and operations on- and off-site.

Noise impact mitigation measures are often enforced at the Building Permit stage of project processing, to assure that building structure design will achieve the mitigation standards specified in the approval documents. Interior noise mitigation measures may include requirements for sound transmission rate of different building elements, mechanical ventilation, etc. Table 4 provides a grouping of some applicable mitigation measures that can be utilized to address the Significance Guidelines.

Table 4
Typical Mitigation Measures when Significance Guidelines are Exceeded

Reference	Significance Guideline	Typical But Not Exclusive Mitigation Applied to Reduce Effects Below Significance
4.1.A.i	Exterior locations: > 60 dBA CNEL	Noise Barriers* (Solid walls, fences, earthen mounds), enclosures, noise easements.
4.1.A.ii	Exterior locations: >=10 dBA CNEL increase over existing conditions	Noise Barriers* (Solid walls, fences, earthen mounds), enclosures.
4.1.B	Interior locations: >45 dBA CNEL	Building placement, architectural design, noise protection easements.
4.1.B.i	Interior locations: >50 dBA Leq hourly	Building placement, architectural design, noise protection easements.
4.2.A	Non-construction noise: Section 36.404 of the County Noise Ordinance	Noise Barriers* (Solid walls, fences, earthen mounds, parapets), enclosures, source location, operating hours, monitoring.
4.2.B	Construction-related noise: Section 36.410 of the County Noise Ordinance	Noise Barriers* (Solid walls, fences, earthen mounds, parapets), enclosures, source location, operating hours, monitoring.
4.3	Ground-borne vibration and noise impacts	Source modifications (dampening devices/materials), trenches, operational changes, buffer zones, monitoring.

* Noise barriers are expected to reasonably meet applicable zoning requirements for height and location.

Mitigation for noise impacts attributed to planned roadways, as specified in the County Circulation Element, may be implemented in some instances at the time when the roadway is constructed. However, the noise analysis prepared for a project must demonstrate that reasonable mitigation measures are available to mitigate impacts below a level of significance.

6.0 REFERENCES

American Society for Testing and Materials 1997
"Standard Test Method for Measurement of Airborne Sound Attenuation Between Rooms in Buildings" E336-05.

California Code of Regulations
Noise Insulation Standards. Title 24, Chap. 2-35.

California Department of Transportation
Environmental Program Environmental Engineering – Noise, Air Quality, and Hazardous Waste Management Office.
- Traffic Noise Analysis Protocol for New Highway Construction and Reconstruction Projects, October 1998.
- Transportation- and Construction-induced Vibration Guidance Manual, June 2004.
- Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects, August 2006.

California Health & Safety Code
California Noise Control Act (HSC §46000-46080)

California Public Resources Code
California Environmental Quality Act (PRC §21000-21178).

California State Building Code
Part 2, Title 24, CCR, Appendix Chapter 3, Sound Transmission Control, 1988.

City of San Diego Noise Limits.

County of San Diego
San Diego County Code ("Noise Ordinance"), Title 3, Division 6, Chapter 4, Section 36.401
General Plan, Part VIII, Noise Element, December 17, 1980.

Federal Interagency Committee on Noise (FICON)
"Federal Agency Review of Selected Airport Noise Analysis Issues", August 1992.

Federal Aviation Administration
Federal Aviation Regulations, Part 150 Airport Noise Compatibility Planning, January 18, 1985.

Fidell, S., Barber, D., and Schultz, T.J. (1991). "Updating a Dosage-Effect Relationship for the Prevalence of Annoyance due to General Transportation Noise." J. Acoust. Soc. Am. 89, 221-233.

Housing and Urban Development (HUD)
HUD Noise Limits. The Noise Guide Book, September 1991.

International Standard Organization (ISO), ISO 362; ISO 1996 1-3; ISO 3095; and ISO 3740-3747.

San Diego Association of Governments
SANDAG regulations for example, Comprehensive Land Use Plan Borrego Valley Airport, San Diego County, California, September 1986.

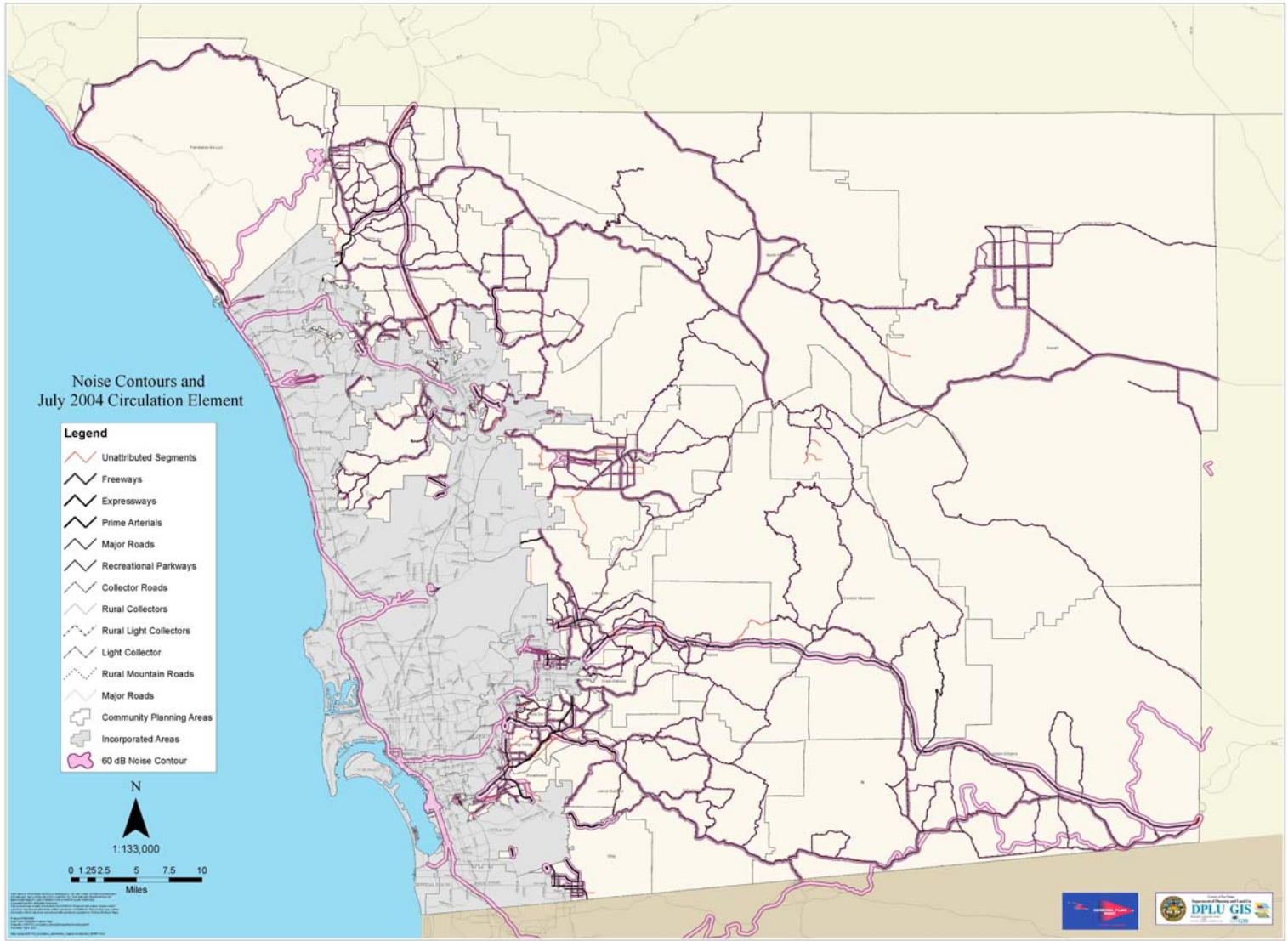
Schultz, T.J. (1978) "Synthesis of Social Surveys on Annoyance Due to Noise," J. Acoust. Soc. Am. 64, 377-405.

United States Department of Labor
Occupational Safety and Health Administration, Regulations, (Standards -29 CFR), Part 1910, "Occupational Health and Safety Standards", April, 2006.

United States Department of Transportation
Federal Highway Administration, Office of Environment and Planning, Noise and Air Quality Branch. "Highway Traffic Noise Analysis and Abatement Policy and Guidance," Washington, D.C., June 1995.
Federal Railroad Administration. "High-speed Ground Transportation and Vibration Impact Assessment," Final Report", August 2005.
Federal Transit Administration. "Transit Noise and Vibration Impact Assessment," FTA-VA-90-1003-06, Final Report, May 2006.

Wyle Research Report. Development of Ground Transportation Systems Noise Contours for the San Diego Region, WCT 73-8, December 1973.

Figure 1
San Diego County CNEL Contour Map



[Attachment A]

Sounds Levels Associated with Various Noise Sources and Events

Noise Source	A-weighted Sound Level, dB	Environment
Jet Engine at 80 ft	130-140	Threshold of Pain
Unmuffled Motorcycle at 3 ft Jet take-off at 300 feet	120-130	
	110-120	Rock and Roll Concert
Pneumatic Chipper Pile driver at 50 ft	100-110	Express train passing
Air Compressor at 20 ft Power lawnmower	90-100	Boiler Room Textile weaving plant
Food blender Freight train at 100 ft	80-90	Tabulating room Ventilation and equipment room
Vacuum cleaner Automatic Dishwasher	70-80	Busy downtown area Next to busy freeway
Speech at 1 ft	60-70	Large business office Next to busy street
Large transformer at 200 ft	50-60	Average residence with radio Large store Conversational speech
Occasional private auto at 100 ft Bird calls	40-50	Average residence, without radio Motion picture theater
Soft whisper at 5 ft Library	30-40	Room in quiet house at midnight
	20-30	Radio broadcasting studio
	0	Threshold of Hearing youth

[**Attachment B]**

Relationship Between Noise Exposure and Percentage of Community Highly Annoyed

Item	Source	Day-Night Average Sound Level in decibels (*)							
		50	55	60	65	70	75	80	85
Percentage of Highly Annoyed	USAF	1.7%	3.3%	6.5%	12.3%	22.1%	36.5%	53.7%	70.1%
	Schultz	2.1%	4.0%	7.5%	13.6%	23.3%	37.1%	53.2%	68.9%

(*) Numerically, Day-Night Average Sound Level and CNEL are practically the same (difference is within ±1 dB).

Sources: Federal Interagency Committee on Noise (FICON) "Federal Agency Review of Selected Airport Noise Analysis Issues", August 1992, p. 3-6, Figure 3.1: Comparison of logistic fits.
Synthesis of Social Surveys on Annoyance Due to Noise, by T.J. Schultz. (1978) J. Acoust. Soc. Am. 64, 377-405.

[Attachment C]

Screening Criteria for Potential Adverse Traffic Noise Effects

Road Classification	Roadway Design ROW Width (feet)	# of Travel Lanes	Median Width (feet)	ADT at LOS C	Traffic Mix		Traffic Speed (mph)	CNEL Noise Contour Distance for C/L (ft)			
					% MT	% HT		CNEL 60 dB	CNEL 65 dB	CNEL 70 dB	CNEL 75 dB
Expressway	146	6	34	70,000	5	3	55	1,000	500	250	120
Prime Arterial	122	6	14	44,600	5	3	55	800	380	180	100
Major Road	98	4	14	29,600	5	3	55	580	270	120	60
Collector	84	4	0	27,400	5	2	45	360	170	80	N/A
Light Collector	60	2	0	7,100	5	1	45	130	60	N/A	N/A
Rural Collector	84	2	0	7,100	5	1	40	110	50	N/A	N/A
Rural Light Collector	60	2	0	7,100	5	1	40	110	50	N/A	N/A
Rural Mountain	100	2	0	7,100	5	1	40	110	50	N/A	N/A
Recreational Parkway	100	2	0	7,100	1	0.5	25	50	N/A	N/A	N/A

Notes: The estimates are based on the following generalized assumptions: subtended angle – 85 to 85 degrees; "level" topography; "soft site" sound propagation conditions (4.5 dB noise reduction per the doubling of distance); 24-hour traffic distribution per Wyle Laboratories Report "Development of Ground Transportation Systems Noise Contours for the San Diego Region" (1973).

C/L – roadway centerline.
CNEL – Community Noise Equivalent Level in decibels (dB).
%MT – percent of medium trucks.
%HT – percent of heavy trucks. Traffic mix data are averages of traffic counts by County of San Diego Department of Public Works. Actual traffic mix may differ from the averages listed above.
N/A – noise contour does not exist or is less than 50 ft from the road centerline.

Warning: The above data should be used only to determine if there is the potential for noise sensitive land uses being impacted by present or future excessive noise levels. Actual noise contour distances could be different (generally, shorter). For project determinations, a noise survey must be completed using actual information on traffic volume, mix, speed, project topography, etc.

[Attachment D]

Screening Criteria for Potential Adverse Ground-Borne Vibration and Noise Effects[1]

Land Use Category	Screening Distance (feet from ROW or property line)
Category 1: Buildings where low ambient vibration is essential for interior operations. (research and manufacturing facilities with special vibration constraints[2]) Special Use Buildings: Concert Halls, TV Studios, and Recording Studios	600 feet
Category 2: Residences and buildings where people normally sleep. (hotels, hospitals, residences, and other sleeping facilities) Special Use Buildings: Auditoriums and Theaters	200 feet
Category 3: Institutional land uses with primarily daytime use. (schools, churches, libraries, other institutions, and quiet offices)	120 feet

Source: U.S Department of Transportation, Federal Transit Administration, "Transit Noise and Vibration Impact Assessment," May 2006.

Notes:

1. This table was developed for transportation corridors with conventional commuter railroads and rapid rail transit for the different land use categories defined in the Federal guidelines. These distances are therefore the most conservative values to be used as a screening tool for the requirement of vibration studies. Please note non-transportation vibration sources such as construction equipment and other activities may be reviewed on a site specific basis by the County using criteria developed by Caltrans (2004) for structures and potential annoyance. Please refer to Tables 19 and 20 in their vibration guidance manual for criteria related to continuous and transient sources

2. This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. Vibration sensitive manufacturing or research will require detailed evaluation to define acceptable vibration levels. Ensuring lower vibration levels in a building often requires special design of the HVAC systems and stiffened floors. In general, vibration-sensitive equipment is not sensitive to ground-borne noise.